IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

REPLY BRIEF FOR THE APPELLANTS

Ex parte Jianzhong ZHANG, *et al.*

APPARATUS, AND ASSOCIATED METHOD, FOR A MULTIPLE-INPUT, MULTIPLE-OUTPUT COMMUNICATION SYSTEM

Serial No. 10/080,933
Confirmation No. 6502
Appeal No.: TBD
Group Art Unit: 2611

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Encl: Reply Brief

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
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In re the Appellant:

Jianzhong ZHANG, *et al.* | Appeal No.: TBD

Serial Number: 10/080,933 | Group Art Unit: 2611

Filed: February 22, 2002 | Examiner: Jean B. Corrielus

Confirmation No. 6502

For: APPARATUS, AND ASSOCIATED METHOD, FOR A MULTIPLE-INPUT, MULTIPLE-OUTPUT COMMUNICATION SYSTEM

REPLY BRIEF

August 17, 2010

I. INTRODUCTION

This Reply Brief is filed in response to the Examiner's Answer dated August 2, 2010. In the Examiner's Answer, while no new grounds of rejection were explicitly made, comments and explanations are provided which are tantamount to new points of argument. This Reply Brief, therefore, is submitted to address these new points of argument, and to clarify why claims 21, 23-28, 30-33, 36-38, 40-42, 46 and 47 of the pending application should be considered patentable over Zangi, Ketchum, and Taylor. These claims, therefore, should be found by this Honorable Board of Patent Appeals and Interferences to be allowable.

This Reply Brief is directed to the deficiencies in the Examiner's Answer.

Appellants' Appeal Brief, however, is maintained, and failure to repeat the arguments contained therein, or to address one or more arguments set forth in the Examiner's Answer, should not be construed as a waiver or an admission. The Appeal Brief speaks for itself, and this Reply Brief merely supplements the Appeal Brief to address certain aspects of the Examiner's Answer.

II. STATUS OF CLAIMS

Claims 21, 23-28, 30-33, 36-38, 40-42, 46 and 47, all of the claims pending in the present application, are the subject of this appeal. Claims 21, 23-26, 28, 30-33, 36, 38, 40-42, 46, and 47 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable as obvious over Zangi in view of Ketchum. Claims 27 and 37 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable as obvious over Zangi in view of Ketchum and Taylor.

III. APPELLANTS' ARGUMENTS

The Examiner's Answer took the position that Zangi discloses the decision feedback sequence estimator (DFSE) recited in claims 21, 23-28, 30, 31, 46 and 47, and similarly recited in claims 32, 33, 36-38, and 40-42. Specifically, the Examiner's Answer alleged that Zangi does not explicitly disclose that the equalizer 100 is a DFSE. The Examiner's Answer referred to column 3, lines 60-64, of Zangi to allege that the equalizer may be a DFE or a DFSE, and further referred to column 4, lines 19-21, and column 8, lines 50-51,

of Zangi to allege that the equalizer 100 is a DFE. The Examiner's Answer further alleged that the summer 106, the feedback filter 104 and the decision algorithm 108, as disclosed in Zangi, collectively correspond to the DFSE recited in the pending claims. The Examiner's Answer alleged that elements 106, 104 and 108 of Zangi are connected in the same way and produce the same result as the DFSE recited in the pending claims. Appellants respectfully disagree with the allegations presented in the Examiner's Answer.

As discussed in the Appeal Brief, Zangi is directed to a method for computing a coefficient of a finite impulse response pre-filter applied prior to a decision algorithm in an equalizer having adjustable filter coefficients. Computations performed to compute the filter coefficients for a right half burst may be used to compute the prefilter for a left hand burst, reducing the number of computations. A square root-free algorithm may be used to solve the system of linear equations, reducing computational complexity (Zangi, col. 2, lines 8-39).

Zangi explicitly discloses an equalizer 100, which may be a decision feedback equalizer (DFE) *or* a DFSE equalizer. Although Zangi does not explicitly disclose that the equalizer 100 is simply a DFSE, Zangi does disclose that the only element illustrated in Figure 3 that is a DFSE is the equalizer 100. As discussed in the Appeal Brief, the equalizer 100 includes an equalization filter 101, *a decision algorithm 108*, and a processor 120. Equalization filter 101 includes a prefilter 102, *a feedback filter 104*, and *a summer 106*. Processor 120 includes a channel estimator 122 and an adaptive algorithm 124 (Zangi, Figures 1 and 3; col. 3, line 29, to col. 4, line 60). Thus, the equalizer 100, which Zangi

discloses as a DFSE, includes a feedback filter 104, a summer 106, and a decision algorithm 108, *i.e.*, all three structural elements are contained *within* the DFSE 100 (*see* Zangi, Figure 3). Zangi further discloses that the *DFSE 100 includes the pre-filter 102, the channel estimator 122, and the adaptive algorithm 124*, *i.e.*, the pre-filter 102, the channel estimator 122, and the adaptive algorithm 124 are also contained *within* the DFSE 100. Accordingly, a person of ordinary skill in the relevant art would have understood that the DFSE 100 is not "configured to receive the generated optimized values" (emphasis added), rather, the optimized values are generated *within* the DFSE 100. DFSE 100 only receives the "received sequence, *r(k)*."

Appellants respectfully submit that the Examiner's Answer unreasonably and erroneously re-grouped the elements of the DFSE 100 of Zangi to exclude the processor 120, so that the "optimized values" generated within the adaptive algorithm 124 could be received within the newly grouped DFSE (only including the feedback filter 104, the summer 106, and the decision algorithm 108). As previously discussed, Zangi explicitly describes that the DFSE 100 *includes* the processor 120, the channel estimator 122, and the adaptive algorithm 124, and therefore the optimized values are generated *within* the DFSE 100, not *received* by the DFSE 100. Therefore, Appellants respectfully submit that Zangi fails to disclose or suggest the DFSE, as recited in the pending claims. As discussed in the Appeal Brief, neither Ketchum nor Taylor disclose or suggest the DFSE, as recited in the pending claims, and therefore fail to cure the deficiencies of Zangi (*see* pages 14-16 and 29 of the Appeal Brief).

As acknowledged in the Office Action dated February 16, 2010 ("Office Action"), Zangi fails to disclose or suggest the features for the MIMO system recited in the pending claims. The Examiner's Answer took the position that Ketchum cures the deficiencies of Zangi with respect to these features. The Examiner's Answer took the position that Zangi and Ketchum are in the same field of endeavor and are both applicable to signal detection/interference reduction using equalization processing, and therefore a person of ordinary skill in the relevant art would have been motivated to combine Zangi and Ketchum. Appellants respectfully disagree with these allegations.

As discussed in the Appeal Brief, certain embodiments of the invention provide non-obvious advantages. Specifically, certain embodiments of the invention relate to a MIMO communication system, whereby interference cancellation and equalization pre-filtering operations at a receiving station of the MIMO communication system are performed. Hence, the system includes a joint encoder, a MIMO transmission, and a MIMO receiver.

Ketchum is directed to a time-domain transmit and receive processing with channel eigenmode decomposition for MIMO systems. Ketchum discusses techniques for processing a data transmission at a transmitter and receiver. A time-domain implementation is provided in Ketchum that uses frequency-domain singular value decomposition and "water-pouring" results to derive time-domain pulse-shaping and beam-steering solutions at the transmitter and receiver. The singular value decomposition is performed at the transmitter to determine eigenmodes (*e.g.*, spatial subchannels) of a

MIMO channel and to derive a first set of steering vectors used to "precondition" the received signals so that orthogonal symbol streams are recovered at the receiver. Water-pouring analysis is used to more optimally allocate the total available transmit power to the eigenmodes, which then determines the data rate and the coding and modulation scheme to be used for each eigenmode (Ketchum, col. 2, line 25, to col. 3, line 10).

A person of ordinary skill in the relevant art would not have found it obvious to combine Zangi with Ketchum. The Examiner's Answer alleged that it would have been obvious to combine Zangi and Ketchum to improve signal detection since the system would have been able to be configured to receive multiple copies so that existence of signal error can be easily determined (*see* Examiner's Answer on page 6). Appellants respectfully disagree with these allegations.

A person of ordinary skill in the relevant art would have understood that the fundamental differences between the features for the system discussed in Ketchum and the features of the system discussed in Zangi would have made it non-obvious to combine Zangi and Ketchum. For example, Ketchum discusses applying singular value decomposition (SVD) to derive time-domain *pulse-shaping* and *beam steering* solutions at a transmitter. Additionally, Ketchum discusses the application of the SVD at the receiver to restore orthogonality (*see*, for example, the abstract of Ketchum) of the orthogonal symbol streams. Embodiments of the invention are not directed, nor require, *pulse-shaping*, *beam steering*, or orthogonal symbol streams. A person of ordinary skill in

the relevant art would have concluded that these fundamental differences between Zangi and Ketchum demonstrate that a combination of Zangi and Ketchum would not have been obvious. Such a person would have also understood that such a combination would render Zangi unsatisfactory for its intended purpose, and therefore would not have been motivated to combine these references. As discussed in the Appeal Brief, Taylor fails to disclose or suggest the features of the MIMO system, as recited in the pending claims, and therefore fails to cure the deficiencies of Zangi and Ketchum (*see* page 29 of the Appeal Brief).

For the reasons discussed in the Appeal Brief and further for the reasons discussed above, Appellants respectfully submit that none of the prior art references, whether taken individually or in combination, disclose or suggest every feature recited in claims 21, 23-28, 30-33, 36-38, 40-42, 46 and 47.

Furthermore, claims 23-28, 30, 31, 46 and 47 depend from, and further limit, claim 21. Claims 33, 36 and 37 depend from, and further limit, claim 32. Claims 40-42 depend from, and further limit, claim 38. Accordingly, claims 23-28, 30, 31, 33, 36, 37, 40-42, 46 and 47 should be allowable for at least their dependency upon an allowable base claim, and further, because they recite additional features. Appellants respectfully request that the pending claim rejections be reversed and claims 21, 23-28, 30-33, 36-38, 40-42, 46 and 47 be allowed.

IV. CONCLUSION

Appellants respectfully submit that the Examiner's Answer fails to demonstrate that

combinations of Zangi, Ketchum and Taylor disclose or suggest every feature recited in claims 21, 23-28, 30-33, 36-38, 40-42, 46 and 47. Specifically, the Examiner's Answer fails to demonstrate that combinations of the prior art references of Zangi, Ketchum and Taylor disclose or suggest the DFSE and the features of the MIMO system, as recited in the pending claims.

Appellants respectfully request that this Honorable Board of Patent Appeals and Interferences reverse the Examiner's decision in this case and indicate the allowability of all of pending claims 21, 23-28, 30-33, 36-38, 40-42, 46 and 47.

In the event that this paper is not being timely filed, Appellants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees which may be due with respect to this paper may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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